

# **ELECTRIC POWER TOOL**

## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention**

5           The present invention relates generally to electric power tools, and more particularly, to a direct-current electric power tool.

### **2. Description of the Related Art**

          The power source of a general electric power tool can be alternate current and direct current provided by a battery pack, wherein the latter is more popular than the  
10   former with common amateur users.

          A commercially available direct-current power tool, such as U.S. Patent Nos. 5,799,739 and 5,902,080, is primarily composed of a tool unit and a battery pack. The tool unit includes a coupling receptacle having a receiving chamber formed therein, an opening in communication with the receiving chamber, and an electrical contact  
15   disposed inside the chamber. The battery pack includes a connector protruded outwards and an electrical output contact. The connector of the battery pack is inserted into the chamber to enable the electrical output contact to electrically connect the electrical contact and to enable the battery pack to connect the tool unit.

          The battery pack further includes a locking device having a button and a pawl.  
20   When the battery pack is connected with the coupling receptacle, the pawl engages with a block positioned on an inner periphery corresponding to the pawl to secure the battery pack to the tool unit from disengagement. When the user intends to remove the battery pack from the tool unit, it is easy to remove the battery pack from the tool unit by pressing the button to enable the pawl to disengage from the block.

25           The aforementioned connector and receiving chamber must have enough length

and deepness to enlarge the contact area between the connector and the chamber to further enhance the cohesiveness between the battery pack and tool unit, thereby preventing the battery pack from shake which causes imperfect contact between the electrical output contact of the battery pack and the electrical contact of the tool unit.

5 Hence, the battery pack and the tool unit will structurally and dimensionally enlarged to cause inconvenience for carrying the electric power tool.

Additionally, when the battery pack is connected with the tool unit, the pawl is directly burdened with the whole weight of the battery pack to easily damage the pawl or the block while the battery pack is slightly impacted to further cause the battery pack  
10 to disengage from the tool unit; this aforementioned drawback can be found in U.S. Patent No. 5,799,739. Further, because the battery pack is controlled to disengage from the tool unit by one single button, it is easy to cause the user to carelessly touch the button to further cause the battery pack to disengage from the tool unit while operating the power tool.

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## **SUMMARY OF THE INVENTION**

The primary objective of the present invention is to provide an electric power tool, in which a battery pack thereof and a tool unit thereof are preferably tight connected with each other.

20 The secondary objective of the present invention is to provide an electric power tool, in which the size of a battery pack thereof and a tool unit thereof are effectively reduced.

The foregoing objectives of the present invention are attained by the electric power tool, which is composed of a tool unit and a battery pack. The tool unit includes a  
25 pair of conjunct grooves and two corresponding blocks. The battery pack includes a pair

of conjunct rails and two locking members. The tool unit and the battery pack are connected and locked with each other respectively by that the conjunct grooves and the conjunct rails are interconnected with each other and the two locking members and the two blocks are jammed together. In addition, the tool unit and the battery pack can be  
5 dimensionally reduced and the cohesive effect therebetween can be strengthened respectively by the conjunct grooves and the conjunct rails.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a schematic view of a preferred embodiment of the present invention;

10 FIG. 2 is a partial exploded view of the preferred embodiment of the present invention;

FIG. 3 is a perspective view of a coupling member of the preferred embodiment of the present invention viewing from the bottom side thereof;

FIG. 4 is a sectional view taken from a line 4-4 indicated in FIG. 1.

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### **DETAILED DESCRIPTION OF THE INVENTION**

Referring to FIGS. 1-3, an electric power tool A constructed according to a preferred embodiment of the present invention is composed of a tool unit 1 and a battery pack 2.

20 The tool unit 1 includes a tool body 10 and a coupling member 20 connected to a bottom side of the tool body 10, wherein the tool body 10 is well known to the one who is skilled in the art, such that no more description of the tool body 10 is required. A receiving chamber 21 is formed inside the coupling member 20 and defines a bottom opening 211 and a lateral opening 212 respectively at a bottom side and a lateral side of  
25 the coupling member 20, wherein the bottom opening 211 and the lateral opening 212

communicate with each other. The coupling member 20 has a pair of parallel skeleton-like members 22 positioned at bilateral sides of the chamber 21 and extending respectively from an end thereof in proximity of the lateral opening 212 towards the other end thereof. Each of the two skeleton-like members 22 has a conjunct groove 221  
5 extending from the one end thereof in proximity of the lateral opening 212 towards the other end thereof. The two conjunct grooves 221 respectively define two openings facing to each other and two insertion holes 222 formed at two ends thereof in proximity of the lateral opening 212. The coupling member 20 further has two curbs 23 positioned respectively at two bottom sides of the two skeleton-like members 22. Each  
10 of the two curbs 23 defines a root end 231 and a free end 232 at two ends thereof, the two free ends 232 of the two curbs 23 facing to each other, and has a guide surface 233 extending from the free end 232 towards the root end 231 thereof and the insertion hole 222. The coupling member 20 further has electrical contacts 24 positioned inside the chamber 21.

15           The battery pack 2 includes a housing 30, two locking members 40, two springs 50, and a set of battery cells 60.

          The housing 30 has a battery compartment 31 formed inside for receiving and securing the battery cells 60. A power output contact 32 is disposed on the housing 30 at a position thereof corresponding to the electrical contact 24 for electrically connecting  
20 electrodes of the battery cells 60. The housing 30 further has a top cover 33 and a pair of conjunct rails 34 formed on the top cover 33 for accommodating the two conjunct grooves 221. The two conjunct rails 34 are parallel to each other and each is provided with a first end 341 and a second end 342, wherein the two first ends 341 are positioned at the same side, and so are the two second ends 342. Each of the conjunct rails 34 has a  
25 root portion 343 and a rail portion 344, wherein the two root portions 343 respectively

extend vertically upwards from the top cover 33, and the two rail portions 344 extend horizontally respectively towards opposite directions. While the two first ends 341 of the two conjunct rails 34 respectively face towards the two insertion holes 222 of the two conjunct grooves 221, the two rail portions 344 can be respectively inserted through  
5 the two insertion holes 222 and into the two conjunct grooves 221 to enable the housing 30 to be connected with coupling members 20. Two slots 331 are formed on the top cover 33 and positioned respectively at two lower sides of the two root portions 343 of the two conjunct rails 34. Two cavities 35 are formed respectively at two lateral symmetrical portions of the housing 30 and have two openings 351 positioned at two  
10 lateral sides of the housing 30. Two through holes 352 are formed respectively at bottom sides of the two cavities 35 and communicate with the battery compartment 31. In addition, the housing 30 further has two flanges 36 extending outwards respectively along parts of fringes of the two openings 351.

Each of the two locking members 40 has a button 41, locking portion 42, and  
15 an arm portion 43 connecting the button 41 and the locking portion 42. Each of the buttons 41 has a main body 411 and a raised ridge 412. Each of the two main bodies 411 is flat and is provided with an exterior surface 411a, an interior surface 411b, and a recessed portion 413 formed on the exterior surface 411a for a hand's pressing. The two raised ridges 412 respectively correspond to the two flanges 36 of the housing 30 and  
20 extend outwards respectively from parts of outer peripheries of the two main bodies 411. Each of the two arm portions 43 is elongated flat and defines a root end 431 and a distal end 432, wherein each of the root ends 431 is connected to the interior surface 411b of the main body 411 of the button 41. The locking member 42 is a lug formed at the distal end 432 of the arm portion 43 and has a second guide surface 421 thereon.

25 While the two locking members 40 are connected to the housing 30, the two

buttons 41 are positioned respectively inside the two cavities 35 and each of the two exterior surfaces 411a of the two main bodies 41 is exposed outside the opening 351. The two arm portions 43 are inserted respectively through the two through holes 352 and into the battery compartment 31. The two locking members 42 respectively pass  
5 through and out of the two slots 331 to be positioned respectively under the two rail portions 344 of the two conjunct rails 34.

The two springs 50 are positioned respectively inside the two cavities 35 and each has two ends contacting respectively against the bottom side of the cavity 35 and the interior surface 411b of the main body 411 of the button 41.

10 Referring to FIG. 4 together with FIGS. 1-3, the two first ends 341 of the two conjunct rails 34 face the lateral opening 212 of the coupling member 20 to further enable the two rail portions 344 to be inserted through the two insertion holes 222 and into the two conjunct grooves 221. Push the housing 30 to enable the two rail portions 344 to completely slide into the two conjunct grooves 221. Meanwhile, the second  
15 guide surfaces 421 of the two locking portions 42 pass through the two curbs 23 to enable the two second guide surfaces 421 of the two locking portions 42 to be pushed respectively by the two first guide surfaces 233 of the two curbs 23 to further drive the two locking members 40 to move towards inside of the housing 30; after the two locking portions 42 of the two locking members 40 pass by the two curbs 23, the two  
20 rail portions 344 completely slide into the two conjunct grooves 221, and the two locking members 40 are respectively supported by the two springs 50 to return respectively to original positions and to respectively engage the two curbs 23, thereby avoiding disengagement of the battery pack 2 from the tool unit 1. Accordingly, the tool unit 1 and the battery pack 2 are coupled with each other.

25 When the user intends to remove the battery pack 2 from the tool unit 1, the

user can press the two buttons 41 of the two locking members 40 by two fingers (ex. thumb and first finger, or thumb and middle finger) of one single hand to respectively drive the two locking portions 42 to disengage from the two curbs 23 and to simultaneously draw the battery pack 2 to enable the two rail portions 344 to slide out of the two conjunct grooves 221, thereby removing the battery pack 2 from the tool unit 1.

In conclusion, the electric power tool A constructed according to the first preferred embodiment of the present invention includes advantages as follows.

1. Because the conjunct grooves 221 and the conjunct rails 34 are small-sized, the tool unit 1 and the battery pack 2 are more effectively dimensionally reduced than the prior art to facilitate carrying and using the electric power tool A.
2. The locking portions 42 of the two locking members 40 are mounted at the lower sides of the rail portions 344 of the conjunct rails 34, such that the space under the rail portions 344 can be effectively utilized to effectively reduce the size of the electric power tool A.
3. While the conjunct grooves 221 and the conjunct rails 34 are interconnected, the coupling member 20 engages against the top cover 33 of the housing 30 at the bottom side thereof to enlarge the contact area between the tool unit 1 and the battery pack 2 and to enforce the connection therebetween to further effectively avoid shaking therebetween.
4. When the battery pack 2 is coupled with the tool unit 1, the weight of the battery pack 2 is supported by the conjunct grooves 221 and the conjunct rails 34 rather than supported by the two locking portions 42 and the two

curbs 23, such that the tool unit 1 and battery pack 2 are secured preferably tight.

5. To remove the battery pack 2 from the tool unit 1, the user has to simultaneously press the two buttons 41 of the two locking members 40.

5 Accordingly, the disengagement of the battery pack 2 from the tool unit 1 caused by carelessly touching any of the two locking members 40 can be avoided while the user is operating the electric power tool A.